

# Plastics Recycling WORLD



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# Upcycling of plastic using Nouryon's Perkadox® PM-W75

In Nouryon's new technology, an organic peroxide is used in the reactive extrusion of polypropylene to increase the molecular weight, and therefore decrease the MFI. By Dr. J.M. van der Schuur, Nouryon R&D

A paradigm shift is an important change that happens when the usual way of thinking about or doing something is replaced by a new and different way. It is undisputable that the polymer industry is living through a paradigm-shift: the traditional linear economy from crude to waste is transforming into a circular economy where waste is the resource. Such a deep transformation cannot be achieved by the plastic recyclers or the polymer producers alone but requires the contribution of all players in the plastic cycle.

Nouryon is a global leader in specialty chemicals providing essential solutions to manufacture everyday products, such as packaging, paints and coatings, building products, etc. Our Polymer Specialties business has a long history in supplying the polymer, rubber and resin industry with reactive chemicals for their production, crosslinking and curing. While our products are already known by recyclers to modify the properties of recyclate, our latest development opens up the possibility for the upcycling of plastic.

## The problem

Most of the properties of recycled plastics, in particular recycled plastics from post-consumer waste, are inferior to virgin material. Compared to virgin polypropylene, recycled polypropylene has for instance a lower molecular weight and poorer mechanical properties<sup>[1]</sup>. This is due to exposure to UV and sunlight during the polypropylene article's use and lifetime; the reprocessing of this used material also has an adverse effect on its subsequent mechanical properties.

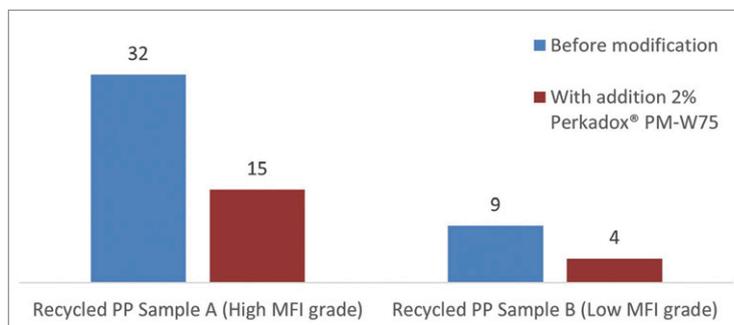


Figure 1: MFI (g/10min) of Recycled PP before and after 2% addition of Perkadox® PM-W75 product.

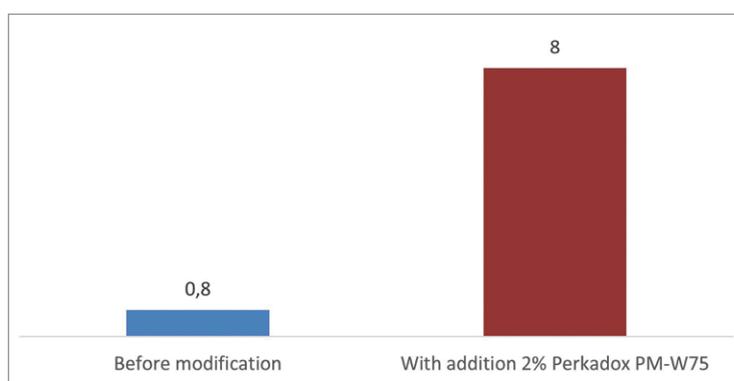


Figure 2: Melt strength (cN) of recycled polypropylene (Sample B) before and after 2% addition of Perkadox® PM-W75 product.

## Nouryon's upcycling technology

The modification of recycled polypropylene to tune its molecular weight and thereby its Melt Flow Index (MFI), is commonly known in the recycling industry. For example, by using organic peroxides in reactive extrusion, the MFI of the recycled polypropylene can be increased.

It is important to note that in current processes, the MFI of recycled polypropylene in general always increases, which is equivalent to a molecular weight decrease, thus leading to inferior mechanical properties.

Nouryon has invented and patented<sup>[2]</sup> a new technology in which an organic peroxide is used in the reactive extrusion of polypropylene to increase the molecular weight, and therefore decreases the MFI. By using small amounts of the organic peroxide Perkadox® PM-W75, the MFI can be

decreased (see Figure 1), restoring the MFI of the recycled polypropylene, so that it is comparable to the MFI of the virgin polypropylene. This is known as upcycling.

In addition, Melt Strength and Melt Elasticity of the modified recycled polypropylene increases strongly (see Figure 2). This will enable new processing opportunities and applications like foaming, blow moulding and even thermoforming.

<sup>[1]</sup> Luzuriaga, S.; Kovářová, J.; Fortelný, I.; *Polymer Degradation and Stability*, 2006, 91, 1226-1232

<sup>[2]</sup> J.M. van der Schuur et al., Nouryon, WO2019/038244 A1

# Nouryon

## Interested?

To learn more about this new technology and Nouryon's range of products for the plastic recycling industry, go to <https://www.nouryon.com/markets/polymer-processing/polymer-recycling> or contact us at [elisa.conte@nouryon.com](mailto:elisa.conte@nouryon.com)